

PERSONAL INFORMATION

First and Family name	Federico Sánchez Nieto	Spanish citizen	
ID number	27304777-M	Born	17/02/1969 Badajoz (Spain)
Researcher numbers	Researcher ID	F-5809-2012	
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Current position

Name of University/Institution	Université de Genève		
Department	Département de physique nucléaire et corpusculaire (DPNC)		
Address and Country	24, quai Ernest-Ansermet CH-1211 Genève 4		
Phone number	+41 223796227	E-mail	federico.sancheznieto@unige.ch
Current position	Professeur Ordinaire	From	01/08/2018
Espec. cód. UNESCO	2290-02		
Keywords	Neutrino experiments, neutrino-nucleus cross-sections, particle detector, instrumentation		

Education

Grade	Institution	Year
University graduate	Universidad de Sevilla	1992
PhD in Physics	Universitat Autònoma de Barcelona	1997

Employment history

Institution	Position	Years
IFAE	Predoctoral grant	1993-1997
IFAE	Postdoctoral position	1997
DESY	Postdoctoral position	1997-2000
MPI-fK	Postdoctoral position	2000-2002
Univ. Autònoma Barcelona	Tenure Track (Ramon y Cajal)	2002-2007
IFAE	Researcher	2007-2018
Université de Genève	Professeur ordinaire	Aug 2018 --

Research index parameters from Google Scholar

H index: 76	Average citations per article: 98.7
Total number of citations: 25162	Total number of articles: 255

Supervision of graduate students and postdoctoral fellows

PhD directed	X.Espinal, A.Y.Rodriguez, F.Nova, G.Jover, J.L.Alcaraz, J.Caravaca, A.Garcia, R.Castillo, L.Maret, B.Bourguille In preparation: S.Pina, C.Jesus, D.Vargas, S.Parsa, R.Amarinei, D.Douqa
Postdocs	T.Lux, M.Ieva, C.Giganti, A.Andringa, M.Leyton, S.Di Luise, S.Bordoni
Master Thesis	C.Jesus, C.Martin, A.Lostao, R.Viruez, F.Nova, E.Aliu, A.Bercowsky, D.Douqa
Undergraduates	P.Garcia, M.Albareda, C.Koch, R.Ravel, D.Muñoz, A.Marquez
Others	7 research projects for secondary school students

Teaching experience

1. Introduction to Statistics at the master of High Energy Physics, Astrophysics & Cosmology from 2012 until 2017.
2. Introduction to Statistics at the BIST Interdisciplinary research 2017-2018.
3. Neutrino physics for the Master of Particle Physics at the University of Geneva. 2019 and 2020.
4. Course on Neutrino physics at the CERN Latin American School of Physics 2017.

Awards & Fellowships

1. Breakthrough price on Fundamental physics 2016
2. ICCR Visiting Professor in June-August 2003.
3. IPMU-Kavli Visiting Professor March 2016.

Memberships in panels & boards and individual scientific reviewing activities

- Director Department Particle Physics at the University of Geneva since August 2020.
- T2K International Co-Spokesperson since 2019.
- T2K executive committee from 2014 until 2019.

- Member of the NusTec executive board.
- Member of the Institutional Board of T2K, Hyper-Kamiokande and WA105.
- Member of the International Interim Executive for of LBNE. (2015)
- Member of the Severo-Ochoa Scientific Strategy group at IFAE.
- Member of the Conveners Group of the ND280 detector (G4)
- Chair of the Jennifer European collaboration board (until 2019).
- Member of the multidisciplinary research group at the Barcelona Institute of Science and Technology (BIST) as IFAE representative (until 2018).
- Reviewer: Research projects, Juan de la Cierva, Ramon y Cajal (Spain), Research Projects (STFC), ERC Grants and Colciencias research (Colombia).
- Member of the IFAE advisory panel until 2018.
- Reviewer of the Barcelona Institute of Science and Technology Ignite program 2017 & 2018.
- Referee for PRL, PRD, NIM, JHEP and JINST

Approved research projects

1. Title: FISICA DE NEUTRINOS EN T2K Y I+D PARA FUTUROS EXPERIMENTOS. Ministerio de Economía y Competitividad (FPA2014-59855-P) Jan14-Dec16 Budget: 155500€ Principal investigator: F.Sanchez
2. Title: Participación en el experimento T2K. Ministerio de Economía y Competitividad (FPA2011-29823-C02-02) Nov12 - Oct14 Budget: 283000€ Principal investigator: Federico Sanchez
3. Title: Física experimental de neutrinos: T2K and NEXT. Ministerio de Ciencia e Innovación (FPA2009-13697-C04-03) Jan10-Dec11 Budget: 22200€ Principal investigator: Federico Sanchez
4. Title: Participación en los experimentos T2K y NEMO/SUPERNEMO. Ministerio de Ciencia y Educación (FPA2006-12120-C03-03). Nov06-Oct09 Budget: 531200€ Principal investigator: Federico Sanchez
5. Title: Estudio de la oscilación de Neutrinos en el experimento K2K. Ministerio de Ciencia y Educación (FPA2003-06921-C02-01) Jan03-Dec06 Budget: 384500€ Principal investigator: Federico Sanchez
6. Title: Particle detector and Instrumentation group at IFAE. SGR Agaur (SGR 1177 2014) Jan14-Dec16 Budget: 43200€ Principal investigator: Sebastian Grinstein
7. Title: JENNIFER. Finance institution: European Commission Reference: 644294 Oct14-Sept18 Budget: 103.500€ Principal investigator: Federico Sanchez.
8. Title: ZPro. Barcelona Institute of Science and Technology May17-Dec17 Budget: 20.000€ Principal investigator: Federico Sanchez
9. Title: Towards neutrino CP violation: Strengthening the Japanese neutrino program T2K and Hyper-Kamiokande. SNF Code: 20FL21_186178 Principal investigator: Federico Sanchez. Budget: 911'704 CHF.
10. Title: TOWARDS THE IMPROVEMENT OF NEUTRINO OSCILLATION MEASUREMENTS: T2K AND THE JAPANESE PROGRAM. SNF Code: 200021_185012 Principal investigator: Federico Sanchez. Budget: 483'691 CHF.

Conference organization

- Chair of the 6th International Workshop on Neutrino-Nucleus Interactions in the Few-GeV Region (NUINT 09) Sitges (Spain) 2009 (Chair)
- Chair of the ECT Workshop "Modelling Neutrino-Nucleus interactions" July 2018. (Chair)
- Chair of the ECT Workshop "Testing and Improving Models of Neutrino Nucleus Interactions in Generators" June 2019. (Chair)
- Co-Chair of the Nufact'08 School Benasque (Spain) (Chair).
- Co-Chair NUMU2019 workshop at PSI. Oct 2019.
- XLII International Meeting on Fundamental Physics. 2014 Benasque (Spain) (Co-Chair)

Major scientific achievements related to the proposal

1. **First indication of CP violation in neutrinos:** T2K is seeing the first indication of CP violation in neutrinos. The evidence is getting stronger and stronger. The result was published by Nature in April 2020. <https://www.nature.com/articles/s41586-020-2177-0>
2. **Discovery of ν_μ to ν_e oscillations:** The first time a transition to an explicit neutrino flavour was the first result from T2K and a breakthrough on the search for CP violation with neutrinos.
 1. Abe, K., et al., "Indication of Electron Neutrino Appearance from an Accelerator-Produced Off-Axis Muon Neutrino Beam", Physical Review Letters, v. 107.
 2. Abe, K. et al., "Evidence of electron neutrino appearance in a muon neutrino beam: Physical Review D, v. 88.
 3. Abe, K., et al., "Observation of Electron Neutrino Appearance in a Muon Neutrino Beam: Physical Review Letters", v. 112.
3. **Discovery of ν_μ in accelerator produced neutrinos:** K2K was the first experiment to muon neutrino disappearance based on a man-made neutrino beam. It was a fundamental result to confirm results by atmospheric neutrinos.
 1. Aliu, E., et al., "Evidence for muon neutrino oscillation in an accelerator-based experiment", Physical Review Letters, v. 94.
 2. Ahn, M. et al., "Measurement of neutrino oscillation by the K2K experiment", Physical Review D, v. 74.
4. **Measurement of atmospheric neutrino oscillation parameters:** T2K is up to date the most sensitive experiment on the θ_{23} mixing angle. This result has importance for the search of CP violation and to understand the shape of the mixing matrix.
 1. Abe, K., et al., "First muon-neutrino disappearance study with an off-axis beam", Physical Review D, v. 85
 2. Abe, K., et al., "Measurement of Neutrino Oscillation Parameters from Muon Neutrino Disappearance with an Off-Axis Beam", Physical Review Letters, v. 111.
 3. Abe, K., et al., "Precise Measurement of the Neutrino Mixing Parameter θ_{23} from Muon Neutrino Disappearance in an Off-Axis Beam", Physical Review Letters, v. 112.
5. **Cross-section related developments:** The cross-section neutrino nucleus is the tool to identify neutrino flavour and reconstruct the neutrino energy. Its understanding and description is of the highest importance to neutrino oscillations.
 1. Abe, K., et al., "Measurement of the inclusive $\nu(\mu)$ charged current cross section on carbon in the near detector of the T2K experiment", Physical Review D, v. 87.
 2. Abe, K, et al., "Measurement of inclusive double-differential ν_μ charged-current cross section with improved acceptance in the T2K off-axis near detector", Physical Review D, v98.
 3. Gran, R., et al., "Measurement of the quasi-elastic axial vector mass in neutrino interactions on oxygen", Physical Review D, v. 74.
 4. Rodriguez, A. et al., Measurement of single charged pion production in the charged-current interactions of neutrinos in a 1.3 GeV wide band beam: Physical Review D, v. 78.
6. **Neutrino interaction phenomenology:** The cross-section neutrino nucleus is the tool to identify neutrino flavour and reconstruct the neutrino energy. Cross-sections require both experimental results and phenomenology to implement in event generators.
 1. Gran, R., J. Nieves, F. Sanchez, and M. J. Vicente Vacas, 2013, Neutrino-nucleus quasi-elastic and 2p2h interactions up to 10 GeV: Physical Review D, v. 88.
 2. Nieves, J., F. Sanchez, I. R. Simo, and M. J. V. Vacas, Neutrino energy reconstruction and the shape of the charged current quasielastic-like total cross section: Physical Review D, v. 85.
 3. L.Alvarez-Ruso et al., "NuSTEC White Paper: Status and Challenges of Neutrino-Nucleus Scattering", FERMILAB-PUB-17-195-ND-T, INT-PUB-17-020, [arXiv:1706.03621v2](https://arxiv.org/abs/1706.03621v2)
 4. J.E.Sobczyk, J Nieves and F.Sanchez, "Exclusive-final-state hadron observables from neutrino-nucleus multinucleon knockout", Phys.Rev.C 102, 024601.
7. **Time projection chamber (TPC) technology:** The TPC has been a critical element to the success of T2K. It provides the energy resolution to measure neutrino energy with precision, the identification of muon charge to separate neutrinos from antineutrinos and the electron identification.
 1. Abgrall, N., et al , "Time projection chambers for the T2K near detectors",NIM, v. 637, p. 25.
 2. Lux.T et al. , "Development and characterization of a multi-APD xenon electroluminescence TPC", Journal of Instrumentation Volume: 10
8. **Scintillator based detectors for neutrino physics:** The TPC are critical but it has low mass. Segmented scintillator detector is the base of T2K near detector. This technique was pioneered in K2K and SciBoone with the SciBar detector.
 1. A.Blondel et al., The SuperFGD Prototype Charged Particle Beam Tests, [arXiv:2008.08861 [physics.ins-det]].
 2. Nitta, K., et al, The K2K SciBar detector: Nuclear Instruments & Methods in Physics Research Section a-Accelerators Spectrometers Detectors and Associated Equipment, v. 535, p. 147.

9. **Design, construction and operation of the T2K experiment:** The T2K Near detector has been one of the keys of its success. I was involved in the design of the detector as one of the four conveners in charge of the design and construction.
 1. Abe, K., et al., "The T2K experiment" NIM A, v. 659, p. 106-135.
10. **Applications of Artificial Intelligence algorithms to neutrino physics:**
 1. S.Pina-Otey, F.Sanchez, V.Gaitan and T.Lux, Likelihood-free inference of experimental neutrino oscillations using neural spline flows, Phys. Rev. D 101 (2020) no.11, 113001
 2. S.Pina-Otey, V.Gaitan, F.Sanchez and T.Lux, Exhaustive neural importance sampling applied to Monte Carlo event generation, Phys. Rev. D $\text{\textbf{102}}$ (2020) no.1, 013003
 3. S.Alonso-Monsalve, D.Douqa, C.Jesus-Valls, T.Lux, S.Pina-Otey, F.Sanchez, D.Sgalaberna and L.H.Whitehead, Graph neural network for 3D classification of ambiguities and optical crosstalk in scintillator-based neutrino detectors," [arXiv:2009.00688 [hep-ex]].